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CHE 349-002: Kinetics and Reactor Design

Nellone Reid

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ChE 349: Kinetics and Reactor Design

Spring 2021

Instructor: Dr. Nellone Reid, Senior University Lecturer

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Webex Link: <https://njit.webex.com/meet/ner3>

TA: Ruossong Dong

TA Email: rd466@njit.edu

Class: Tuesday, Thursday, 9:00 AM – 10:20 AM EST

Office Hours: Wednesday, 10:00 AM – 12:00 PM

Friday, 10:00 AM – 11:00 AM

Course Description and Requirements

Derive and solve species and energy balances for single chemical reactors processing liquid and gaseous systems; chemical reactor process safety; multiple reaction applications; catalysis, including mechanisms, rates, reactor design

Pre-Requisites: Chem 236 (Physical Chemistry), ChE 342 (Chemical Engineering Thermodynamics II), ChE 370 (Heat and Mass Transfer), Math 222 (Differential Equations)

Course Objectives

- To provide students with the basic knowledge of how to design chemical reactors.
- To inform students with an awareness of chemical reactor process safety
- To inspire students to approach reactor design with an ethical and environmental awareness through a research orientation.

Learning Materials

Textbook Required: Essentials of Chemical Reaction Engineering (5th ed), H. Scott Fogler, Prentice Hall, ISBN: 0-13-388751-0

Calculator: A high-end calculator (TI-83, TI-84 or TI-84SE) is required for solving exam problems.

Software: : You must have access to and know how to use a math solver software package. Examples include Polymath, Maple, Matlab, Mathcad, and Mathematica. It will be needed for the term project and some homeworks. Polymath is available on dep't PCs in 411 Tiernan, as is the license info for program download onto your PC. A solver is NOT needed on quizzes.

Needs–Requirements for Remote Learning: During school closure, access to a computer or laptop with high-speed internet connection, webcam, microphone, and audio is required. Note that if you have any issues with accessibility to Webex/Canvas and webcams, you must resolve them as soon as possible by contacting the Dean of Students and/or the chair of the Chemical and Materials Engineering department. Inaction on your part is not an acceptable excuse for any issues you may face during the online lectures, quizzes, and exams

Tentative Course Outline

Date	Topic
Week 1 – January 19/21	Introduction and Molar Balances
Week 2 – January 26/28	Mass Balances in Reactors
Week 3 – February 2/4	Conversion and Reactors in Series
Week 4 – February 9/11	Rate Laws and Stoichiometry
Week 5 – February 16/18	Quiz 1
Week 6 – February 23/25	Steady-state energy balance
Week 7 – March 2/4	PFR energy balances
Week 8 – March 9/11	Multiple Reactions
Week 9 – March 16/18	Spring Break
Week 10 – March 23/25	Quiz 2
Week 11 – Mar 30/April 1	Non-elementary reactions
Week 12 – April 6/8	Enzyme/bioreactors
Week 13 – April 13/15	Diffusion and mass transfer in catalysis
Week 14 – April 20/22	Quiz 3
Week 15 – April 27/29	Final Exam Review

Quiz 1 – Thursday, February 18, 2021

Quiz 2 – Thursday, March 25, 2021

Quiz 3 – Thursday, April 22, 2021

Final – TBD

Assessment and Grading

Homework	25%
Quizzes	45%
Final	30%
	100%

A = > 90; B+ = 89.99 – 85; B = 84.99 – 75; C = 74.99 – 65; D = 64.99 – 60; F = < 59.99

Policies

NJIT Honor Code: The NJIT Honor Code will be upheld and any violations will be brought to the immediate attention of the Dean of Students.

Special Needs: If you need accommodations due to a disability please contact Chantonette Lyles (Chantonette.Lyles@njit.edu), Associate Director of Disability Support Services, Fenster Hall Room 260 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

Lectures

- Attendance is strongly recommended. The examples discussed in the class are not necessarily from the main textbook and therefore missing a class will have consequences for preparation to quizzes and exams.
- The classes start at 6:00 PM, and the students must be in class (virtually) by that time. Being late to class may have consequences for the grade, since many of the classes will start from quizzes.

Course materials, office hours and correspondence

- The course Canvas page is the main platform for delivering information about the course. All relevant course materials and assignments will be posted on Canvas, so a student should check it regularly.
- The students should upload a professional-looking headshot for their Canvas profile.
- The students are strongly encouraged to attend Office Hours held bi-weekly. Long questions, which require derivations will be discussed only during the Office Hours and will not be answered by email.
- Questions regarding grades can be discussed only during the Office Hours.
- E-mail and Canvas correspondence is intended only for quick questions. Questions which require a detailed discussion should be discussed in person during the Office Hours.
- All correspondence should be conducted in a professional style, using formal English.
- To assure quick response to your emails, please add “ChE342” in the subject of your emails.
- The instructor reserves the right not to respond to emails if the email does not have a greeting or a signature.

Exams/Quizzes and Grades

- A letter grade is based on the final score, calculated using an Excel spreadsheet in accordance with the Tables given in this syllabus. The assigned letter grade is final and cannot be negotiated.
- A student can dispute the exam scores within a week after the announcement of the score. Exam scores can be disputed during the official Office Hours, not during class time or via email.
- The graded exams must be returned within a week to be saved for the department course assessment initiative.

- Students will get 0 for not showing to quizzes, exams, or any other course activity. If students miss an exam due to extreme circumstances (such as a medical problem), they need to notify the instructor via email before the beginning of the exam, and bring proof of the circumstance to the Dean of Students office. Only in this case of official approval from the Dean of Students office, may a makeup be given at the discretion of the instructor.
- A student must show as many details when solving a problem during an exam or a quiz. Not showing the work will cause losing points even if the final answer is correct.
- Partial credits can be given for solving the exams problems.
- No partial credit will be given if there is not enough details to follow.
- The final answer should be always evaluated with respect to its reasonability. No partial credit will be given if the final answer is wrong and unreasonable, and it is not stated.
- There will be no partial credits for the questions/problems quizzes.
- Student handwriting must be legible in order to receive points.
- A student coming to dispute a grade has to bring completed homework sheets. No discussion of grades will be held without completed homework.

Rules Governing Online Exams/Quizzes

These rules specifically apply to online exams and quizzes conducted via Webex and Canvas. They are generally applicable and subject to change for a specific exam/quiz in view of the needs of the instructor to ensure that potential misconduct is prevented. Hence, the rules below are general, and additional more stringent rules may be imposed during the proctoring of a specific exam/quiz, which will be announced to the students.

1. Please sign in webex, turn webcam on, and mute mode so that exam can start the exam at the designated time promptly. Also make sure student opens a screen on Canvas/Quizzes.
2. Please make sure that the webcam shows student's desk and papers and the upper half of his/her body. So, please optimize the webcam before the exam starts.
3. Please get all materials needed (notes, book, calculator, cell phone, water, candy, chocolate, coffee, etc.) on the desk and visit the restroom before the exam because leaving the desk during the exam is considered cheating. If student has any medical condition that requires a visit to the restroom during the exam, please inform the instructor before the exam indicating the medical situation.
4. If students have questions during the exam, they must use chat functionality in webex. If the question pertains to the whole class, instructor will respond to everybody in chat or by voice.
5. Do not worry about the webcam during the exam unless it freezes for the whole duration; then instructor will contact you. Due to bandwidth issues, sometimes, the videos freeze. Do not worry. Just make sure that turn on your camera at the beginning of the exam, optimize the view, and do NOT turn it off!
6. The submission procedure for Canvas starts with generation of a PDF file of your answer to an exam question through its uploading to the Quiz question page in Canvas. Please make sure you write your name on all answer sheets. Also, when you download the pdf from your gmail account to your laptop/pc, please click on the file name and change the name of the pdf file from what CamScan generates to Lastname Exam2 Q1. Then, submit the renamed pdf file to Canvas.
- 7. The use of cell phone is reserved for scanning and sending email only toward the end of each question period. The use of laptop/pc is reserved for webex, reading the question on Canvas, and uploading your solution PDF to Canvas. Student's use of cell phone beyond the above task or frequent use of laptop/pc will be flagged for misconduct investigation.**
8. If student finishes a question early (before the 5-6 min that should be reserved for scanning/uploading toward the end of duration allotted for each question), he/she should go over the solution because there are many potential mistakes the student might have made like unit conversions, calculations, etc. etc. Toward the last 5-6 minutes of time allotted for each question, just spend the time for submission. There will be NO EXCUSE and the student will get 0 score if he/she cannot submit the answer sheets via Canvas during the allotted time for each question. Please use the allotted time for each question wisely, watch the time counter in Canvas and allow for 5-6 min for upload.
9. In a truly extenuating circumstance like your laptop crashes, wifi dies, etc., use your cell phone to inform me via webex or gmail email indicating what happened. Then connect to Canvas and see the question or email me

and I will send you the question. Only for these extenuating circumstances, at the end of the exam, student will immediately send me an email with a single PDF attachment of all the student's work for Q1, Q2, etc. and explain his/her circumstance in detail. Instructor may not accept student's explanation and ask him/her to retake another exam with different questions.

CRITICAL NOTES TO STUDENTS FOR ONLINE EXAMS

1. **Do NOT use scrap paper.** Write directly on the answer sheet that you plan to scan and submit. Your scanned papers will be used for grading, not your scrap papers.

2. **SHOW ALL WORK, do not skip anything!!!** Write down all fundamental equations, numerical values/units of all variables and parameters. Show all intermediate calculations by plugging numbers into the equations. Show results of intermediate calculations. You will lose a lot of points if your equations are missing. **You will get minimal score, mostly 0, for each step regardless whether your answer is correct or not if the calculations and numbers leading to the answer are missing.**

3. **If the values of parameters, variables, and intermediate calculations are missing or worse incorrect, yet your intermediate calculations and/or final answer are correct, first you will get minimal partial scores, close to 0 points per step, and additionally your paper will be flagged for misconduct investigation.**